

USB

This chapter presents the PC 99 requirements and recommendations for Universal Serial Bus (USB).

USB provides an expandable, hot-attachable Plug and Play serial interface for adding external peripheral devices ranging from interactive HID devices such as joysticks and pointing devices to isochronous devices such as telephony, audio, and imaging devices. USB allows cascading hubs that can be integrated into desktop devices such as monitors and keyboards.

For PC 99, USB provides a standard, low-cost socket that accommodates volume emerging and legacy I/O devices. This feature is required on all PCs, and migration of I/O devices from legacy ports to USB is recommended. In particular, the joystick, pointing device, and keyboard devices that ship with PC systems should be USB.

For Windows and Windows NT support, devices can use the generic class drivers provided with the operating system, or manufacturers can create drivers or WDM minidrivers (depending on the device class) to exploit any additional unique hardware features. For details, see the “I/O Ports and Devices” chapter in Part 4 of this guide.

Manufacturers should ensure that their USB devices are tested at the compatibility workshops provided by the USB Implementers Forum.

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USB Basic Requirements

This section summarizes the basic USB design requirements.

1. USB included on PC 99 system

Required

USB must be included on all PC 99 system types. USB support must be provided for the full bandwidth specified in the *USB Specification, Version 1.0* or later. When a system has more than one host controller, each host controller must provide full bandwidth and isochronous support. Host controllers should be located on PCI to meet this requirement. Host controller placement in other locations (off of ISA or LPT) will likely lead to non-compliant bandwidth or isochronous restriction.

2. Systems include BIOS support for USB keyboards and hubs

Required

PC 99 systems (except those with captive keyboards) must have BIOS support for USB keyboards and hubs. This support must provide the ability for the user to enter the system's BIOS setup utility and also provide enough functionality to install and boot a USB-aware operating system. USB keyboards built as standalone devices, part of a composite device, or part of a compound device must all be recognized and usable. BIOSes are required to support keyboards behind at least one level of external hubs.

3. All USB hardware complies with USB 1.0 specification

Required

Recommended: All USB hardware complies with USB 1.1 specification.

All USB hardware should comply with *USB Specification, Version 1.1* and must comply with *USB Specification, Version 1.0*, published by Compaq, Digital Equipment, IBM, Intel, Microsoft, NEC, and Nortel. This ensures that USB hardware has complete Plug and Play capabilities and is implemented in a standard way.

For example, on any system with USB capabilities, a user must be able to dynamically attach any USB peripheral to any USB connector. The operating system should automatically recognize it, load and initialize the appropriate drivers, and make the device available for use.

4. Connections use USB icon

Required

The icon can be molded, printed, or affixed as a permanent sticker. Because the location and number of USB ports can vary, appropriate icons on both ports and cables are important ease-of-use factors. Therefore, USB icons are required for external cables, connecting cables, and connection ports.

Icons can be based on vendor designs, or vendors can use the recommended USB icon defined in Chapter 6 of the USB 1.1 specification and illustrated here:

The USB icon should be molded into the connector and also placed on the product for ease of identifying the USB port. It is recommended that the icon on the product and the one on the plug be adjacent to each other when the plug and receptacle are mated. This icon can be used for both series A and B connector schemes. On the plug, there should be a 0.635-mm rectangular recessed area around the icon such that there is a perceptible feel of the icon.

5. Devices and drivers support maximum flexibility of hardware interface options

Required

Device and driver designs must provide maximum flexibility of interface options in order to allow user-preference coordination by the operating system or other resource managers. This will allow graceful use of multiple simultaneous devices and applications in a dynamic environment.

Specifically, devices and drivers:

- Must provide multiple alternate settings for each interface where any alternate setting consumes isochronous bandwidth.
- Must not use isochronous bandwidth for alternate setting 0.

It is recommended that devices should consume bandwidth only when the device is being used.

USB Host Controller Requirements

This section summarizes USB class specifications and standards for host controllers.

6. USB host controller meets either OpenHCI or UHCI specification

Required

The host controller must be compliant with the specifications for either OpenHCI (Open Host Controller Interface; published by Compaq, Microsoft, and National Semiconductor) or UHCI (Universal HCI; published by Intel). Hardware manufacturers who design to one of these specifications are not required to provide an additional device driver for their host controller under the Windows or Windows NT operating systems.

Multiple OpenHCI and UHCI USB controllers are supported concurrently by the operating system.

7. USB host controller can wake the system*Required*

The USB host controller must support wake-up capabilities from at least one of the S1, S2, or S3 system sleep states.

USB Hub Requirements

This section summarizes USB class specifications and standards for hubs.

8. USB hubs comply with the *USB Specification, Version 1.1**Recommended*

The *USB Specification, Version 1.1*, defines requirements for USB hubs that cover some ambiguities and close holes in the original 1.0 specification.

9. Bus-powered USB hubs must provide ports that can be individually power switched*RequiredRecommended*

To minimize USB power consumption requirements, bus-powered hubs must provide ports that can be individually power switched. This contributes to the goal of reducing overall system power consumption and is especially important in mobile environments where the ability to absolutely control power consumption from the system, while on battery power, is required.

USB Power Management

This section summarizes the specific USB power management requirements.

10. Systems and devices comply with USB power management requirements*Required*

PC 99 systems must comply with the power management requirements in the *USB Specification, Version 1.0* or later.

In addition, PC 99 devices must comply with the Interface Power Management feature in the *USB Common Class Specification, Revision 1.0* or later.

Design Features for USB Peripherals

This section summarizes requirements related to bus-class specifications and standards for peripherals that use USB.

11. USB devices meet requirements in related USB device class specification*Required*

~~Every device must comply with the *USB Common Class Specification, Version 1.0* or later. For any add-on device or A USB peripheral that fits into one of the USB device class definitions, the device must comply with the related USB device~~

class specification. USB class drivers in the operating system are implemented to support compliant devices in each particular class. Class driver extensions and WDM allow IHVs to innovate and differentiate their products while still meeting class compliance in their base operational modes.

USB References

The following represents some of the references, services, and tools available to help build hardware that is optimized to work with Windows operating systems.

Intel information about USB, including the UHCI design guide for USB

<http://developer.intel.com/design/litcentr/litweb/usb.htm>

<http://developer.intel.com/design/usb/>

Default Device Power Management Specification, Version 1.0, and other device class power management specifications

<http://www.microsoft.com/hwdev/onnow.htm>

OpenHCI: Open Host Controller Interface Specification for USB, Release 1.0a, 10/16/96

<http://www.microsoft.com/hwdev/respec/>

USB Implementers Forum

Phone: (503) 264-0590

Fax: (503) 693-7975

<http://www.usb.org>

All of the specifications listed below are available at

<http://www.usb.org/developers/>

USB Class Definition for Communications Devices, Version 1.0

USB Common Class Specification, Revision 0.9

USB Device Class Definition for Audio Devices, Version 0.9

USB Device Class Definition for Human Interface Devices (HID), Version 1.0

USB Device Class Definition for Mass Storage Devices, Revision 1.09

USB Device Class Definition for Printing Devices, Version 1.0

USB HID Usage Tables, Version 1.0

USB Monitor Control Class Specification, Revision 1.0

USB PC Legacy Compatibility Specification, Revision 0.9

USB Usage Table for HID Power Devices, Version 1.0

USB Specification, Version 1.0

<http://www.usb.org>

Windows NT DDK

MSDN Professional membership

Checklist for USB

If a recommended feature is implemented, it must meet the PC 99 requirements for that feature as defined in this document.

1. USB included on PC 99 system
Required
2. Systems include BIOS support for USB keyboards and hubs
Required
3. a All USB hardware complies with USB 1.1 specification
Recommended
- 3.b All USB hardware complies with USB 1.0 specification
Required
4. Connections use USB icon
Required
5. Devices and drivers support maximum flexibility of hardware interface options
Required
6. USB host controller meets either OpenHCI or UHCI specification
Required
7. USB host controller can wake the system
Required
8. USB hubs comply with the USB Specification, Version 1.1
Recommended
9. Bus-powered USB hubs must provide ports that can be individually power switched
Recommended
10. Systems and devices comply with USB power management requirements
Required
11. USB devices meet requirements in related USB device class specification
Required